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kittlein@gmail.com
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Nota

TENT USE BY *Artibeus* AND *Uroderma* (CHIROPTERA, PHYLLOSTOMIDAE) IN NORTHERN COLOMBIA

Guilherme S. T. Garbino[1], Gabriela C. Rezende[2, 3] and Valeria da Cunha Tavares[4, 5]

[1] Pós-graduação em Zoologia, Dept. de Zoologia, Instituto de Ciências Biológicas, Universidade Federal de Minas Gerais (UFMG), Belo Horizonte, Brazil. [Correspondence: <gstgarbino@hotmail.com>]
[2] Pós-graduação em Zoologia, Dept. de Zoologia, Instituto de Biociências, Universidade Estadual Paulista (UNESP), Rio Claro, Brazil.
[3] IPÊ – Instituto de Pesquisas Ecológicas, Nazaré Paulista, Brazil.
[4] Departamento de Zoologia, Instituto de Ciências Biológicas, Universidade Federal de Minas Gerais (UFMG), Belo Horizonte, Brazil.
[5] Departamento de Ciências Biológicas, Universidade Estadual de Minas Gerais (UEMG), Ibirité, Brazil.

ABSTRACT. During day roosts surveys for bats in the Parque Nacional Natural Tayrona, northern Colombia, we found occupied tents made of leaves of the palm species *Sabal mauritiiformis* and *Cocos nucifera*. We found *Artibeus jamaicensis* and *Uroderma convexum* using the tents, with groups of *U. convexum* ranging from 1 to 23 individuals, and a single occurrence for *A. jamaicensis*. A tent was simultaneously occupied by *U. convexum* and *Thecadactylus rapicauda* (Squamata). Although tent-roosting is known to be a widespread behavior for stenodermatine bats, these are the first observations of tent-roosting bats in northern Colombia and highlight a high potential for finding tent-using bats in the region.

RESUMEN. **Uso de tiendas de hojas por *Artibeus* y *Uroderma* (Chiroptera, Phyllostomidae) en el norte de Colombia**. Durante una búsqueda diurna de refugios de murciélagos en el Parque Nacional Natural Tayrona, en el norte de Colombia, encontramos tiendas hechas de hojas de las palmeras *Sabal mauritiiformis* y *Cocos nucifera*. Encontramos a *Artibeus jamaicensis* y *Uroderma convexum* utilizando las tiendas, con grupos de *U. convexum* que variaban de 1 a 23 individuos y una sola ocurrencia de *A. jamaicensis*. Una tienda era ocupada simultáneamente por *U. convexum* y *Thecadactylus rapicauda* (Squamata). Aunque se sabe que el acampar en tiendas es un comportamiento generalizado para los murciélagos stenodermatine, estas son las primeras observaciones de murciélagos tenderos en el norte de Colombia y destacan un alto potencial para encontrar murciélagos que usan tiendas en la región.

Key words: *Cocos nucifera*, day roost, *Sabal mauritiiformis*, Stenodermatinae, *Thecadactylus rapicauda*.

Palabras clave: *Cocos nucifera,* refugio diurno, *Sabal mauritiiformis,* Stenodermatinae, *Thecadactylus rapicauda.*

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Four out of the nine Neotropical bat families have species that use foliage as day roosts (Kunz & Lumsden 2003). Among foliage-roosting species, phyllostomid bats of subfamilies Rhinophyllinae and Stenodermatinae are the only Neotropical bats known to use modified leaves as shelters, which are commonly known as "leaf tents" (Chapman 1932). The first reports of leaf tents used by bats came from Panama, and most subsequent studies on tent-roosting bats were made in Central America and Trinidad (Barbour 1932; Kunz et al. 1994; Rodríguez-Herrera et al. 2007). Additional records of tent-roosting bat species have been made in Brazil, Colombia, Ecuador, French Guiana, and Peru (Koepcke 1984; Timm 1987; Charles-Dominique 1993; Zortéa 1995; Herrera-Victoria et al. 2018), and currently 20 species of stenodermatine and rhinophylline bats are known to use tents (Garbino & Tavares 2018). However, most of the studies on tent-using bats in South America are based on occasional encounters and provide but a few details on group size, tent architecture and plant species used by the bats.

Aiming to contribute with basic information on tent-roosting bats in northern South America, we describe leaf tents used by *Uroderma convexum* and *Artibeus jamaicensis* in an area of northern Colombia, and comment on group size and composition.

We searched for bats roosting under modified and unmodified leaves along 6.6 kilometers of pre-existing tourist trails in Parque Nacional Natural Tayrona, Magdalena, Colombia (11º18′ N, 53º57′ W) on 3 August 2017 (**Fig. S1**). In most cases, reliable identification of the bats and the plants used as shelter was possible. All visits to roosts were made during daytime, between 11:00 and 15:00 h. We observed and photographed the bats, which could be identified at least to subtribe level.

A total of 13 occupied diurnal roosts of stenodermatine bats were recorded along the transect (**Table 1**). Among them, 10 were tents, one consisted of unmodified foliage, and in two cases we could not determine whether the leaf was modified. Roosts were recorded in two species of palms, *Sabal mauritiiformis* (locally known as "palma amarga") and coconut palms

Table 1
Bat species, group size, plant species, and type of tents recorded.

Bat species	Group size	Plant species	Tent architecture
Artibeus jamaicensis	1 adult	*Sabal mauritiiformis*	umbrella
Uroderma convexum	2 adults	*Cocos nucifera*	pinnate
Uroderma convexum	at least 15 adults and 8 juveniles	*Cocos nucifera*	pinnate
Uroderma convexum	2 adults	*Cocos nucifera*	unmodified leaf
Uroderma convexum	2 adults	*Cocos nucifera*	undetermined
Uroderma convexum	2 adults	*Cocos nucifera*	undetermined
Uroderma convexum	4 adults, 3 juveniles	*Sabal mauritiiformis*	umbrella
Uroderma convexum	15 adults, 8 juveniles	*Sabal mauritiiformis*	umbrella
Uroderma convexum	2 adults	*Sabal mauritiiformis*	umbrella
Uroderma convexum	1 adult	*Sabal mauritiiformis*	umbrella
Unindentified Stenodermatinae	2 adults	*Sabal mauritiiformis*	umbrella
Unindentified Stenodermatinae	at least 5 adults	*Sabal mauritiiformis*	umbrella
Unindentified Vampyressina	1 adult	*Sabal mauritiiformis*	umbrella

(*Cocos nucifera*). Following the tent architecture classification of Kunz et al. (1994), the type observed on *S. mauritiiformis* leaves was most similar to the "umbrella" tent (**Fig. S2**), and the modified coconut palm leaves matched the "pinnate" tent type. The architecture of the umbrella tents made of *S. mauritiiformis* leaves matched what has been described in the literature, as the leaves were chewed on veins and plications were made in a semicircular or polygonal pattern, causing the distal parts of the leaf to hang down (Kunz et al. 1994; Timm 1987). The pinnate tents are constructed by biting the midrib of the palm leaf's leaflets, which fold downward (Timm & Lewis 1991). On the two pinnate tents we found, architecture matched that described in previous studies (Timm & Lewis 1991; García-García & Santos-Moreno 2014), with the leaflets closer to the coconut palm trunk cut at greatest distance from the rachis.

We identified the species *U. convexum* and *A. jamaicensis* using the tents. Characters used to determine the species *U. convexum* included the distinct white stripe crossing the dorsum medially, and not reaching the nape and crown, the bicolored nose leaf with the lateral portions of the horseshoe pale-colored, and the anterodorsal margins of the ear white colored (**Figs. 1A**, **S3-6**). Although the external characters used to recognize the species *U. convexum* largely overlap with those defining *U. bilobatum*, we followed Mantilla-Meluk (2014) considering that only *U. convexum* is found in northern Colombia. We based our identification of a single individual of *A. jamaicensis* that we found in a tent roost in its large size, in the presence of a self-colored nose leaf, its grayish pelage, and not well-marked white stripes, and in the lack of a dorsal stripe (**Fig. 1B**).

A third recorded species could not be recognized by observation and is treated here as "unindentified Vampyressina" (**Fig. S7**). This single animal had a bicolored noseleaf, yellowish lateral borders of the horseshoe, and had a white stripe along the dorsum that did not reach the nape and crown. Based on these characters, the bat could be a species of *Chiroderma*, *Vampyriscus* or *Uroderma*. On one tent with two bats and one with at least five, the bats left the tents before they could be photographed.

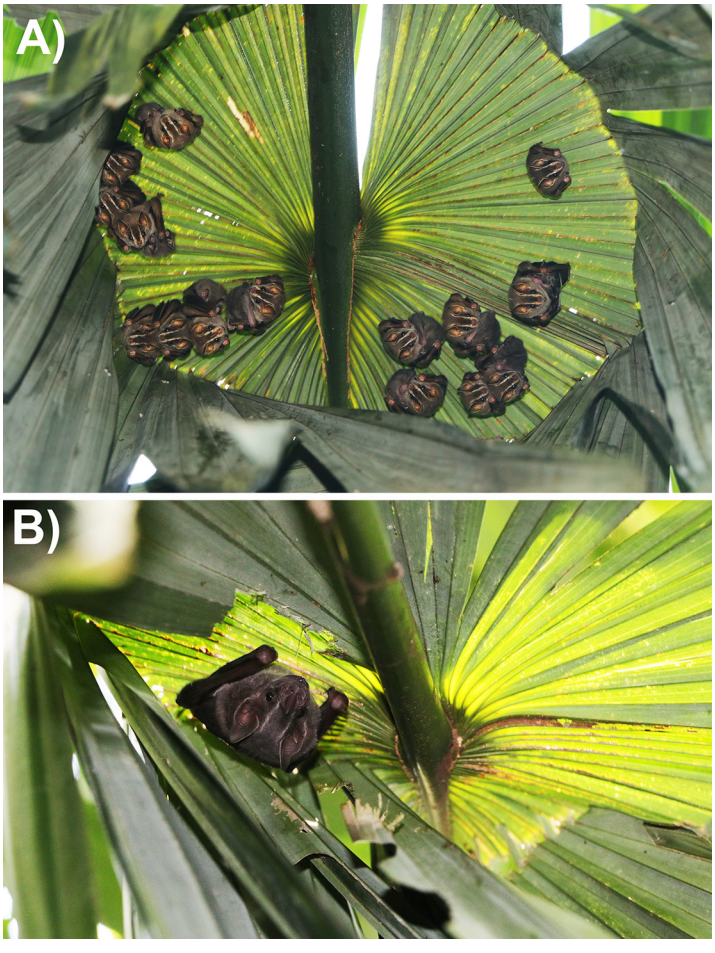

Fig. 1. A) Group of *Uroderma convexum* roosting under the modified *Sabal mauritiformis* leaf depicted in **Fig. S2**; B) *Artibeus jamaicensis* roosting under *S. mauritiiformis* "umbrella" leaf tent.

The single individual of *Artibeus jamaicensis* was found roosting in a *Sabal mauritiiformis* umbrella tent (**Fig. 1B**). This species is opportunistic in its selection of roosts, and may shelter in rock crevices, tree hollows and foliage (Morrison & Handley 1991). Some authors even suggest that it uses tents made by other species (Brooke 1987; Rodríguez-Herrera et al. 2007). Tent-use by *A. jamaicensis* has been previously recorded in Costa Rica (Foster & Timm 1976), on the island of Trinidad (Kunz & McCracken 1996), and in western Colombia (Herrera-Victoria et al. 2018).

We observed nine groups of *Uroderma convexum* with group size ranging from 1 to at least 23 individuals, and more than half of the roosts (5 out of 9) containing pairs (**Table 1**). In the colonies containing more than 2 animals, it was possible to identify the presence of small juveniles. We found roosting groups of *Uroderma convexum* in coconut palm leaves in three occasions, and in three different trees (**Fig. S8**). In one palm tree, we found a large colony containing at least 15 *U. convexum* adults under a pinnate tent (**Fig. 2A**), and two other groups with two bats each in other leaves. Our observations in coconut palm leaves agree with the findings of Timm & Lewis (1991), as the smallest groups of *U. convexum* were found in unaltered leaves, and the large group was under an altered leaf (**Table 1**).

Uroderma convexum has been previously recorded using umbrella tents in Costa Rica (Timm 1987), Panama (Barbour 1932), and western Colombia (Herrera-Victoria et al. 2018). Previous records of *U. convexum* using pinnate tents were made in Costa Rica, in tents made of *Cocos nucifera* and *Attalea butyracea* leaves (Timm & Lewis 1991; Timm & McClearn 2007), and in Mexico, in *A. butyracea* leaves (García-García & Santos-Moreno 2014).

Published studies indicate that males of *Uroderma convexum* and *Artibeus jamaicensis* form harems (Timm & Lewis 1991; Kunz & McCracken 1996), which appears to be the case at least for *U. convexum* according to our data. We observed females with their young in two of the tents of *S. mauritiiformis* (**Figs. 1**, **S3-6**), and in both cases a single individual roosting separately from the rest, which could probably be

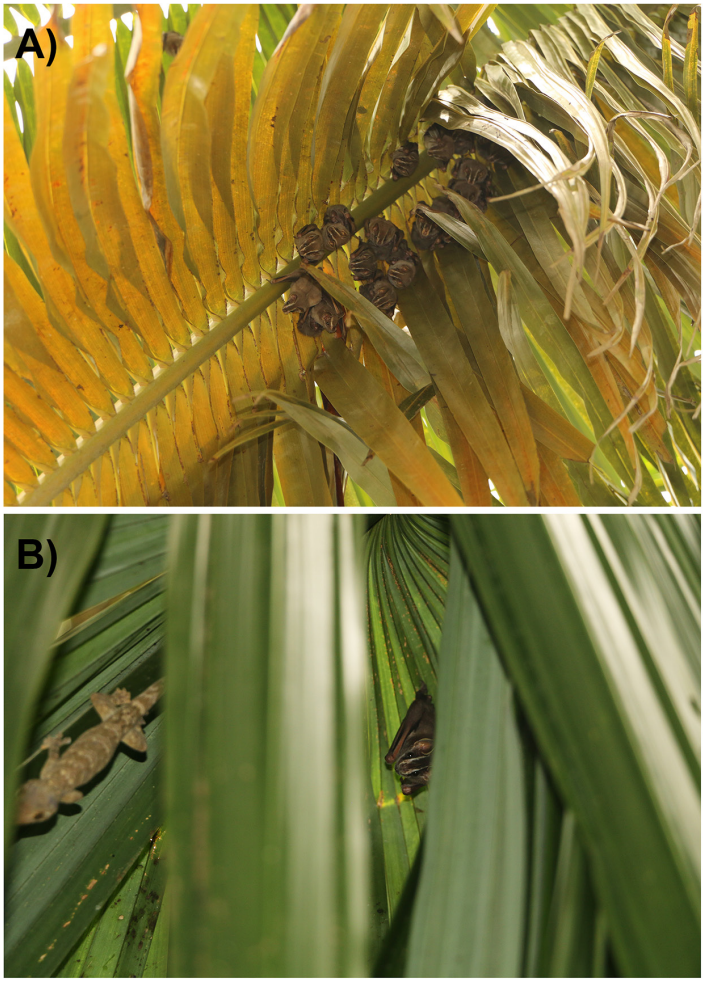

Fig. 2. A) Group of *Uroderma convexum* roosting under a *Cocos nucifera* leaf modified into a pinnate tent, B) *Sabal mauritiiformis* umbrella tent shared by *Uroderma convexum* and *Thecadactylus rapicauda*.

the adult male from the harem. Similar to our observations made in August, Timm & Lewis (1991) observed juveniles with the females in July in Costa Rica, and Fleming (1973) also reported a birth peak between July and August in Panama.

A single tent in an individual of *Sabal mauritiiformis* was occupied simultaneously by one individual of *U. convexum*, and by one nocturnal gecko of the species *Thecadactylus rapicauda* that we found adhered to the leaf's petiole (**Figs. 2B**, **S9**). In the seasonal dry forests of Caribbean Colombia, *T. rapicauda* is more commonly found on the lower forest levels (< 2.5 m high), although it has been recorded in trees of more than 30 m in the Amazonia (Vitt & Zani 1997; Rojas Murcia et al. 2016). This species is also known to use a wide variety of shelters, including tree trunks, branches and limbs, leaves of trees and bromeliads, and even human buildings (Vitt & Zani 1997). Therefore, this single observation of the two species sharing the same roost precludes from making further statements about eventual associations between the bat and gecko species. However, the fact that the gecko shares the same tent with the bat is noteworthy because *T. rapicauda* is preyed by carnivorous bats, such as *Chrotopterus auritus* and *Trachops cirrhosus* (Goodwin & Greenhall 1961; Tuttle 1967), and raises questions to whether there are any sort of recognition clues signaling the harmlessness of that particular bat to the gecko.

Considering that the diurnal roosts were found with relative ease, and many tents were observed along the transect but not personally verified by us, we assume that this region has great potential for studies of the dynamics of tent-roosting by bats.

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SUPPLEMENTARY ONLINE MATERIAL

Supplement 1
https://www.sarem.org.ar/wp-content/uploads/2018/09/SAREM_MastNeotrop_25-2_Garbino-sup1.pdf

Fig. S1. Study site at Parque Nacional Natural Tayrona, Magdalena, Colombia. The red track represents the walked transect.
Fig. S2. A) *Sabal mauritiiformis* palm with a leaf modified into "umbrella" tent (white arrow), B) detail of tent shown in (A).
Fig. S3. Three adult females of *Uroderma convexum* with juveniles, roosting in a *Sabal mauritiiformis* tent.
Fig. S4. Two individuals of *Uroderma convexum* roosting in a *Sabal mauritiiformis* tent.
Fig. S5. Two individuals of *Uroderma convexum* roosting under an unmodified coconut palm leaf.
Fig. S6. Two individuals of *Uroderma convexum* roosting under an unmodified coconut palm leaf.
Fig. S7. Unidentified individual of Vampyressina in a *Sabal mauritiiformis* tent.
Fig. S8. A) Coconut palms (*Cocos nucifera*) where groups of *Uroderma convexum* were observed —the tree palms on the front had bats. The white arrow signals the group in (B). B) Group of *U. convexum* roosting under a pinnate tent.
Fig. S9. Close up of A) *Thecadactylus rapicauda* and B) *Uroderma convexum* in the same *Sabal mauritiiformis* tent.